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RD 54
TASK 5
PHASE I
PROGRESS REPORT #4 - MODEL C

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7 MAY 1956

OBJECTIVE:

To design and develop a miniature voice communicator and to construct two design approval models. After customer evaluation, four development models will be produced, incorporating changes that may be found desirable.

DATA:

1. Optical System.

a. Lenses.

The lens design for both the objective and condenser systems has been completed and orders have been placed for the lens elements. It is expected that the lenses for the design approval models will be on hand by May 18.

The objective system consists of two elements, a cemented doublet and an aplanatic meniscus lens. The combination has a clear aperture of 1.230", a focal length of 1.411" and a relative aperture of f/1.15. The elements are coated for maximum transmission from .8 to 2.5 microns.

The design was based on that of one half the Model B condenser system. The various radii, thicknesses, and spacings were scaled down by applying a factor equal to the ratio of desired focal length to existing focal length. The clear aperture was chosen on the basis of available mounting space.

The initial design obtained in this way was checked by mathematical ray traces. Modifications in radii and thicknesses were made to obtain the desired back focal length and an improvement in the amount of spherical aberration. All calculations were based on red light at .7665 microns. The aplanat lens functions to increase the speed of the doublet without affecting the spherical aberration. The spherical aberration of the final system is well within the allowable tolerance.

The condenser system is a symmetric combination of two of the above objectives scaled down to a .566" focal length (for red light)

and a .493" clear aperture. The relative aperture is the same as the objective, f/1.15. The spherical aberration is well within the allowable value. The symmetry of the system helps to reduce chromatic aberration. Since the system is used only at or near its axis, coma, field curvature, and distortion need not be considered.

b. Galvanometer and Magnet.

The galvanometers were due from Midwestern Instruments on April 21 but have been delayed because they have not obtained satisfactory tubular windows. It will probably be several more weeks before the galvanometers are received.

The sample standard galvanometer was received from Midwestern and has been used in testing the pole piece and magnet design. Tests of the original design indicated a galvanometer sensitivity .8 times the standard value. It was found that a slight increase in both magnet area and length would bring the sensitivity within .9 to 1.0 times the standard. This magnet and pole piece assembly was still of a size that could be accommodated and was considered to be a good solution to the problem. The magnet itself is a stock size horseshoe type which is modified slightly by grinding one leg for clearance of the objective lens housing.

c. Cell.

The sample 1/2 x 1/2 mm lead sulfide cells have been received. It is only necessary to mount them before they can be tested.

d. Sights.

Simple open type sights have been designed and will be mounted on top of the case cover. A white nylon bead will be provided on the front sight to aid alignment under conditions of low ambient light.

e. Modulation Indicator.

A small rectangular window of frosted plastic will be provided on the side of the case. Light reflected from the galvanometer mirror and passing through a narrow slit in the beam turning mirror will form an image on the plastic window. The width of the image will be dependent on the angular deflection of the galvanometer mirror and will thus provide an indication of relative modulation level. A sliding cover will be provided to cover the window when desired.

2. Amplifiers.

It has been found that the separate 15 volt cell bias battery will not be required. The cell current will be supplied through the input transformer primary winding rather than through the usual load resistance. Because of the relatively low resistance winding, the voltage required for normal cell current is considerably less and it becomes possible to use the regular amplifier batteries.

The modulator and receiver amplifier designs are largely complete. The principal remaining work will be involved in making the modifications that will be necessary when the two amplifiers are mounted in the chassis and interconnected. Initial experiments indicate that additional shielding and decoupling will be necessary to prevent coupling between the modulator oscillator and the receiver amplifier when they are both functioning in the "find" mode of operation.

First models of the modulator and receiver amplifiers have been built. After the required modifications have been determined, revised units will be built for the two design approval equipments.

3. Batteries.

Each equipment will be furnished with four Gould type AA storage cells. It will be designed, however, so that either Mallory RM12R mercury cells or standard size AA pen light cells can be used instead.

With the Gould cells an average operating period of 1 to 1-1/2 hours (at 75°F) can be expected before it is necessary to interchange the two pairs of cells. Operation can then be continued for another 1 to 1-1/2 hours before recharging is necessary.

To facilitate charging, a miniature socket will be provided on the control panel to which a suitable battery charger can be connected. In this way it is not necessary to remove the batteries from the case for charging. Also, since no battery holder would be required on the charger, it can be a smaller unit.

If Mallory RM12R mercury cells are used for about 1-1/2 hours intermittent operation each day (75°F), and the two pairs are interchanged each day, about 4 or 5 days operation can be expected. Ordinary pen light cells can be expected to give about 4 days operation at 20 minutes per day under similar conditions of operation.

At the lower ambient temperatures mercury and ordinary dry cells lose capacity rapidly. The Gould storage cells are considerably better and should be usable (at reduced operating time) down to 0°C.

4. Mechanical. CONFIDENTIAL

Parts for a first model of the equipment are nearly complete. These will be assembled and tested and any required modifications determined. The two design approval models will then be built incorporating any changes found necessary. It is expected that many of the parts of the first model will be usable in one of the design approval models.

At present, assembly of the first model is being delayed because all the lenses have not been received, the galvanometer is not ready, and a few mechanical parts are being completed.

PROGRAM FOR NEXT INTERVAL:

If the lenses and galvanometer are received within the next week it should be possible to complete the first model assembly by the end of May. This still allows a possibility of completing the design approval models by June 29 provided no great modifications are required.

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Report prepared by:

Report approved by:

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